HOME ECONOMICS

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VI. THE FUEL FOODS—CARBOHYDRATES

A LUMP of sugar or of starch bears little outward resemblance to the coal that we burn in our stoves or to the wood that gives the cheerful blaze in our fireplaces; yet the sugar and the starch serve much the same purpose as do the wood and coal, and to the wood they bear a close relationship.

The process of oxidation, or burning, is essentially the same whether it be carried on in the stove or in the body. In either case the carbon and hydrogen of the fuel unite with the oxygen of the air to form carbon dioxide and water, and this chemical change produces heat. In one case the union between the elements is so rapid that light also is produced; in the other the combustion is slow; but the total amount of heat is always the same for a given amount of carbon oxidized, whether the combustion be slow or rapid, or whether it take place within the body or without.

Sugar and starch are the most important representatives of the class of fuel foods that we call carbohydrates. The name comes from the fact that these substances are composed of carbon and of the elements of water, hydrogen and oxygen, in the proportion in which they are found in water.

The following classification of the principal carbohydrates will help us to understand and remember them:

STARCH GROUP.	SUCROSE, OR CANE-SUGAR GROUP.	GLUCOSE GROUP.
$(C_6H_{10}O_5)_n$	$C_{12}H_{22}O_{11}$	$C_6H_{12}O_6$
Starch, Dextrin, Cellulose, Glycogen, Gums.	Cane sugar, or sucrose; Milk sugar, or lactose; Malt sugar, or maltose.	Grape sugar, or dextrose; Fruit sugar, or lævulose.

Starch is wholly a vegetable product, and is built up by green plants from the carbon dioxide of the air and from water. It is found in the cells of plants in the form of small grains varying much in size and appearance. So characteristic is the appearance of the starch from different sources that the grains are readily identified under the microscope.

Starch-grains from the potato show a series of concentric markings, and look almost like tiny clam-shells; corn-starch is angular in form, and many of the grains show a distinct cross upon them; wheat-starch presents a great variety in size, but the form is generally oval.

If cooked starch be held in the mouth for a few minutes or chewed it becomes distinctly sweet in taste, owing to the fact that the saliva has the power of changing it into sugar. Starch may also be changed into sugar by certain ferments, like diastase, which cause the malting of the grain in the first process of beermaking, and by the action of acids with heat. An illustration of this action is sometimes observed in cooking when lemon-juice or vinegar has been combined with corn-starch or flour and water and heated. If the cooking be prolonged, the thick mixture often suddenly liquefies from the change of the starch into sugar.

Dextrin is an intermediate product whenever this change takes place. Its formation is one of the first steps in the process of starch digestion. The "predigestion" of certain patent cereal foods consists of the more or less complete change of the starch of the cereal into dextrin and sugar. The simplest way to distinguish dextrin from starch is by the iodine test. A drop of iodine solution added to starch gives a blue color, while with dextrin it gives a red about the shade of port wine.

Glycogen is the form in which carbohydrate is stored in the liver for the use of the body. It is given off to the blood in the form of sugar as it is needed for use.

The gums of the starch group are numerous. Perhaps pectose, the substance that makes fruit jelly "jell," is as important as any from the food standpoint.

The cane-sugar group bears a definite chemical relation to the starch group, which may be roughly expressed by the formula

$$\underset{\text{Starch.}}{2C_6H_{10}O_5} + \underset{\text{Water.}}{H_2O} = \underset{\text{Sugar.}}{C_{12}H_{22}O_{11}}$$

With cane-sugar we are all familiar in the ordinary commercial sugar, the product chiefly of the sugar-cane and of the beet-root. Contrary to the popular impression, the finished product from these two sources is identical. The sugar of the maple is also cane-sugar.

Lactose, the sugar of milk, though having the same composition as sucrose, or cane-sugar, has different chemical properties. It is supposed to be the most digestible of the sugars.

With maltose we are most familiar in malt, a product of the fermentation of the starch in barley or other grains. Maltose is also one of the sugars formed in the process of starch digestion and as a result of the first chemical changes in the making of yeast bread.

The glucose group of sugars is represented chiefly by two substances whose names mean the right-handed and left-handed sugars, because, though these sugars are otherwise identical in composition, when a ray of polarized light is passed through their water solutions dextrose rotates the ray to the right and lævulose to the left. Grape-sugar is found abundantly in the grape, and is the sugar so often found in crystals in raisins. Fruit-sugar, as its name implies, is abundant in most fruits. Glucose is used somewhat loosely to mean either grape-sugar, or a mixture of grape- and fruit-sugar. Commercial glucose is obtained from starch by treating it with acids.

Cane-sugar may also be changed into a mixture of dextrose and lævulose by the action of acids in the presence of moisture and heat, and is then called invert sugar. When in making candy we add vinegar or cream of tartar to prevent the candy from crystallizing we are inverting a portion of the cane-sugar, or changing it to a glucose sugar. We might express the change in this way:

$$\underset{\text{Cane sugar.}}{C_{12}H_{22}O_{11}} + \underset{\text{Water.}}{H_2O} = \underset{\text{Glucose.}}{2C_6H_{12}O_6}$$

(To be continued.)

SOME COMMON POINTS OF WEAKNESS IN HOSPITAL CONSTRUCTION *

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If it be true that, despite the most careful revision of plans by Directing Boards, Medical Boards, and officials, a building is rarely erected that does not immediately upon occupancy show most incomprehensibly glaring defects, and that limited funds not infrequently necessitate arrangements which it is perfectly understood will have to be replaced in the near future at double the cost, it is also true that many of our recent buildings, richly endowed or otherwise, present to the critical eye of the practical worker a similarity of defects which would be avoidable without an increase of the initial expense, and an elimination of which would greatly facilitate the economical running of the most expensive plants which the public are called upon to maintain. Time and the immensity of the subject forbid an attempt to compare the

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